Delta Regional Ecosystem Restoration Implementation Plan (DRERIP): Treatment of Certainty (Understanding and Predictability)

Notes for Delta Independent Science Board prepared by Lauren L. Hastings
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These notes are based on the following draft manuscript:
Hastings, Reed, DiGennaro, Cantrell, Healey, Herbold, Hymanson, Siegel and Swanson. Using Conceptual Models in Ecosystem Restoration Decision Making: An Example from the Sacramento-San Joaquin River Delta, California. In preparation.

In 2004, the California Department of Fish and Game, U.S. Fish and Wildlife Service, and National Marine Fisheries Service, as the designated CALFED Ecosystem Restoration Program (ERP) implementing agencies, initiated work on a Delta Regional Ecosystem Restoration Implementation Plan (DRERIP). The plan was to consider relevant restoration actions from the programmatic ERP Plan which included over 600 possible restoration actions. An Adaptive Management Planning Team (AMPT) consisting of agency technical staff and external science advisors was established to guide the DRERIP effort. The AMPT was tasked with developing a science-based process utilizing conceptual models for evaluating which actions should be implemented as targeted research, pilot studies or as full scale actions under the adaptive management framework, and which actions should be discarded. The resulting science-based process includes these three elements:

- Conceptual Models - linked conceptual models that compile and synthesize the existing scientific understanding of Delta ecosystem function and the basic biology/life histories of key species;
- Action Evaluation Process - standardized scientific evaluation process for evaluating worth, risk, reversibility and opportunity for learning of proposed ecosystem restoration actions; and
- Decision Support Tool - decision tree to determine, based on action evaluation results, whether and how to implement proposed restoration actions in the adaptive management framework.

Part of the Action Evaluation Process is an assessment of the magnitude and certainty of anticipated ecological outcomes of restoration actions. I think the part of interest to the Delta Independent Science Board for documenting the quality of the science is the approach for scoring **certainty** (Table 1), which is based on both **understanding** and **predictability** according to the definitions below:

Understanding describes the known, established, and/or generally agreed upon scientific understanding of the nature of how each driver is linked to each outcome. Understanding may be limited due to lack of knowledge and information or due to disagreements in the interpretation of existing data and information; or because the basis for assessing the understanding of a linkage is based on studies done elsewhere and/or on different organisms, or conflicting results have been reported.

Predictability reflects the degree to which current understanding of the system can be used to predict the role of the driver in influencing the outcome. Predictability is based on understanding of the driver and the nature of how it is linked to the outcome and thus captures variability. For example, understanding of processes may be high but there may be natural variability either on an inter-annual and/or a seasonal basis that is unpredictable. Or the strength of relationships and magnitude of effects may be variable such that properly measuring and statistically characterizing inputs to the model are difficult.

Table 1. Criteria for Scoring Certainty (Understanding and Predictability) of Ecological Outcomes

Certainty -– *the likelihood that a given Restoration Action will achieve a certain Outcome. Certainty considers both the predictability and understanding of linkages in the pathway from the action to the outcome.*
4 - High: Understanding is high (based on peer-reviewed studies from within the system and scientific reasoning supported by most experts within the system) and outcome is largely unconstrained by variability (i.e., predictable) in ecosystem dynamics, other external factors, or is expected to confer benefits under conditions or times when the model indicates greatest importance.
3 - Medium: Understanding is high but nature of outcome is dependent on other highly variable ecosystem processes or uncertain external factors or understanding is medium (based on peer-reviewed studies from outside the system and corroborated by non peer-reviewed studies within the system) and nature of outcome is largely unconstrained by variability in ecosystem dynamics or other external factors
2 - Low: Understanding is medium and nature of outcome is greatly dependent on highly variable ecosystem processes or other external factors or understanding is low (based on non peer-reviewed research within system or elsewhere) and nature of outcome is largely unconstrained by variability in ecosystem dynamics or other external factors
1 - Minimal: Understanding is lacking (scientific basis unknown or not widely accepted), or understanding is low and nature of outcome is greatly dependent on highly variable ecosystem processes or other external factors